Does functional relationship between referents in a sentence affect encoding interference?

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Background. Encoding interference is a phenomenon that has been observed in sentences containing two elements whose features overlap, and it has been attributed to similarity-based interference effects in working memory [1-3]. For example, previous work has shown that accuracy rates drop when answering comprehension questions about a sentence with two noun phrases (NPs) carrying the same grammatical gender feature as compared to NPs with different genders [4-5]. Unrelated work in the field of visual processing has demonstrated that objects are identified more easily when they are presented as part of interacting object pairs (e.g. a pitcher that is arranged as to pour water into a glass) than as part of noninteracting object pairs [6-7]. Here, we examine whether the advantage of interacting elements over non-interacting elements is evident in sentence processing. Specifically, we ask whether interference arising when a sentence contains two NPs with the same grammatical gender feature is mitigated when the referents of the two NPs are perceived to interact.

Method. Two offline comprehension experiments were conducted on Hebrew object relative clauses. Participants read the sentences in rapid serial visual presentation and had to answer comprehension questions about the object of the relative clause, where the options were the filler (correct answer) and the distractor, which was the main clause subject (incorrect answer).

Experiment 1: preceding context manipulation (60 participants, 32 sets). In this experiment the distractor always matched the filler in gender; they were both feminine. We manipulated the type of the context before the experimental sentences. Four types of contexts were presented: 1) a context containing the two NPs in an interacting scenario 2) a context containing the two NPs in a non-interacting scenario 3) a context containing only the filler 4) a general context that does not contain any of the NPs (baseline) (see Table 1). Logistic regression analysis comparing each of contexts 1-3 to context 4 did not reveal any significant effects (see Figure 1).

Experiment 2: event type manipulation (60 participants, 24 sets). Experiment 2 was designed to address a possible limitation of Experiment 1, where the contexts lacked the presupposed information needed to make the non-canonical sentences in Experiment 1 felicitous, therefore failing to justify their use. Thus, Experiment 2 tested the effect of interaction directly within the experimental sentences. To do this, we manipulated Event Type: interacting (e.g., 'X hired Y') and non-interacting (e.g., 'X left before Y'). In addition, we manipulated Gender Match: the match in gender feature between the filler and the distractor, aiming to replicate encoding interference effects found in previous studies [4-5] (see Table 2). A logistic regression analysis which included only random intercepts by participants and items (due to convergence problems), revealed a main effect for event type ($p = .027$) where interacting events improved accuracy rates. The interaction between Event Type and Gender Match was not significant. However, pairwise comparisons revealed that interacting events improved accuracy relative to non-interacting events only in gender match conditions ($p = .022$, see Figure 2).

Discussion. In Experiment 1, interacting elements in a preceding context did not significantly affect accuracy rates, although a very slight trend could be observed. In contrast to our hypothesis, an interacting context was not beneficial for comprehension. In addition, contrary to prior findings [8-9], providing a context including one or both NPs did not seem to strengthen encoding compared to the baseline. However, the results of Experiment 2 indicate that the interacting nature between elements within a sentence can counteract the effect of interference. This may be the result of the interacting event making the sentence more coherent, or possibly of building a stronger conceptual representation and better encoding abstract relationships between the NPs in the sentence [10]. Another possibility is that a mutual interactional event can trigger a more discriminatory process, in which each NP in the interacting relation can draw attention to the other resulting in better encoding.

Table 1. Translation of an example set from the materials of Experiment 1. (Filler in blue, distractor in red).

Preceding context	Sentence	Question
Both NPs, Interacting: the guides$_{[fem]}$ and the tourist$_{[fem]}$ traveled together to the beautiful village yesterday. **Both NPs, Non-interacting**: the guides$_{[fem]}$ arrived yesterday evening at the beautiful village and the tourist$_{[fem]}$ already wandered in it. **Only filler**: the guides$_{[fem]}$ drank coffee together in the small café yesterday. **General**: The full plane took off yesterday on its way to the coastal city.	This morning the tourist.FEM hired the guide.FEM that the locals from the nearby village surprised due to a misunderstanding.	Who did the locals surprise? The guide.fem \ The tourist.fem

Table 2. Translation of an example set from the materials of Experiments 2. (Filler in blue, distractor in red).

Sentence	Question
Interacting: The tourist[FEM\MASC] cheaply hired the guide.FEM that the locals from the nearby village worried during the organized tour. **Non-interacting**: The tourist[FEM\MASC] quickly left before the guide.FEM that the locals from the nearby village worried during the organized tour.	Whom did the locals worry? The guide.fem \ The tourist.[fem\masc]

Figure 1. results of Experiment 1.

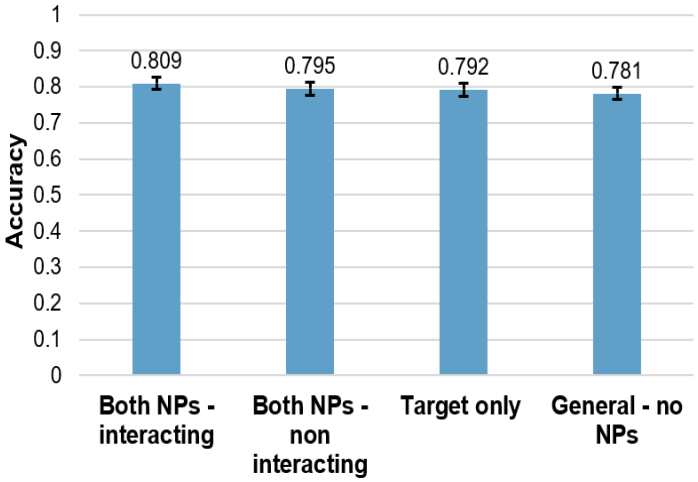
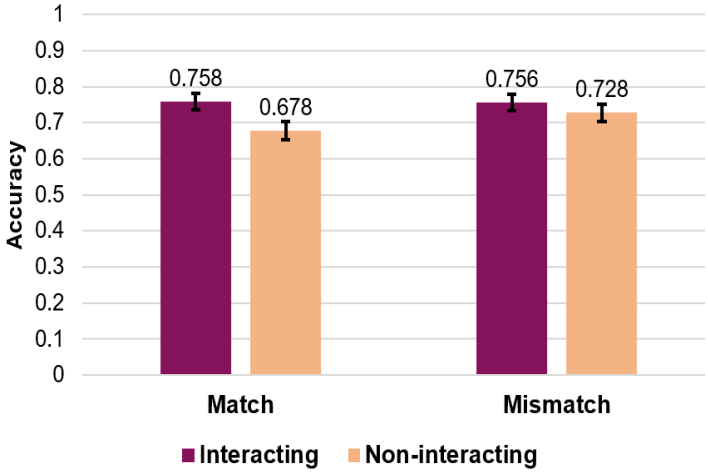


Figure 2. results of Experiment 2.



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